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ROLE OF IOT ENABLED SMART HOMES IN SMART SOCIETY – A REVIEW

K.C Arun^{1}, Farhad Hassan², Muhammad Bilal Awan³, Zubair Hussain⁴, Mubashir Ali⁵*

^{1*}School of Computing, Asia Pacific University of Technology and Innovation, Malaysia

²Department of Computer Science & Engineering, Air University Multan Campus, Pakistan.

³Department of Computer Science, Virtual University of Pakistan.

⁴Ministry of Defence, Qatar.

⁵Department of Software Engineering, Lahore Garrison University, Lahore, Pakistan.

^{1*}kchandran.arun@staffemail.apu.edu.my, ²h.farhad007@gmail.com,

³mbilalawan@gmail.com, ⁴zubairhussainwarsi@gmail.com, ⁵dr.mubashirali1@gmail.com

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ABSTRACT:

Rapid advances in telecommunications technology and the fiery evolution of the Internet of Things have helped the physical world to interact seamlessly with activators, sensors, and digital devices while preserving continuous network communication. Automation changing the structure of world. A world that is continuously connected with computer objects creates a wonderful home system and different approaches have been made to execute the IOTSH (internet of things based smart home) to ease the daily routine. Smart building and smart homes can directly effect on smart society. Use of sensors, internet and microcomputer enabled us to digitalized the world with automation. The main objective of this paper is to highlight the applications of several home automation technologies and future requirements needed in this field. This work elaborates the role of automation in smart society. Furthermore, we reviewed the internet of things contribution in context of smart homes in tabular form. After that, the supporting technologies for home automation systems are discussed.

INTRODUCTION

The Internet has changed the life of a person by providing a place to connect anyone with any time. Similarly, advancements in hardware sectors such as processors, sensors, transmissions, receivers have led to rapid development in

the field of communication and to change the pace of daily life. Over the past few years, Internet of Things (IoT) devices have begun to become an increasingly significant part of our everyday lives. Households have experienced rapid changes since the industrial revolution. For the past one hundred and fifty years a variety of technologies from oven to range, washing machines to refrigerators, lawn to sprinklers and televisions and cars have become an integral part of the home. Each wave of technology has taken back what home is, what it means to be at home and what each family member is [1]. Transistors made electronic technology faster available in the mid-20th century, devices began to control themselves in a very restricted way, using built-in sensors and system administrators. But now, in the 21st century the idea of a fully functional home is actually becoming more accessible. We are investigating the idea of a smart home by integrating IoT services and cloud computing into it by introducing sensors to sensors and activists. However, communicating smart objects using complementary technologies and facilitating smart collaboration. By using cloud computing to easily access various locations, increases computing power, storage space and improves data exchange productivity. Some issues are faced with current good home systems. First of all, free, recreational, health care or smart house keeping activities are created by sub-systems that are either too difficult or impossible to integrate together. Second, the needs of operators have changed, and the strategy of smart home structure must be reformed accordingly. Thus, the availability of current smart home systems is unhealthy, in addition it relies heavily on a particular computer, since they use the home computer as a doorway for communication between the home system and the remote control platform. It is therefore complex regeneration process.

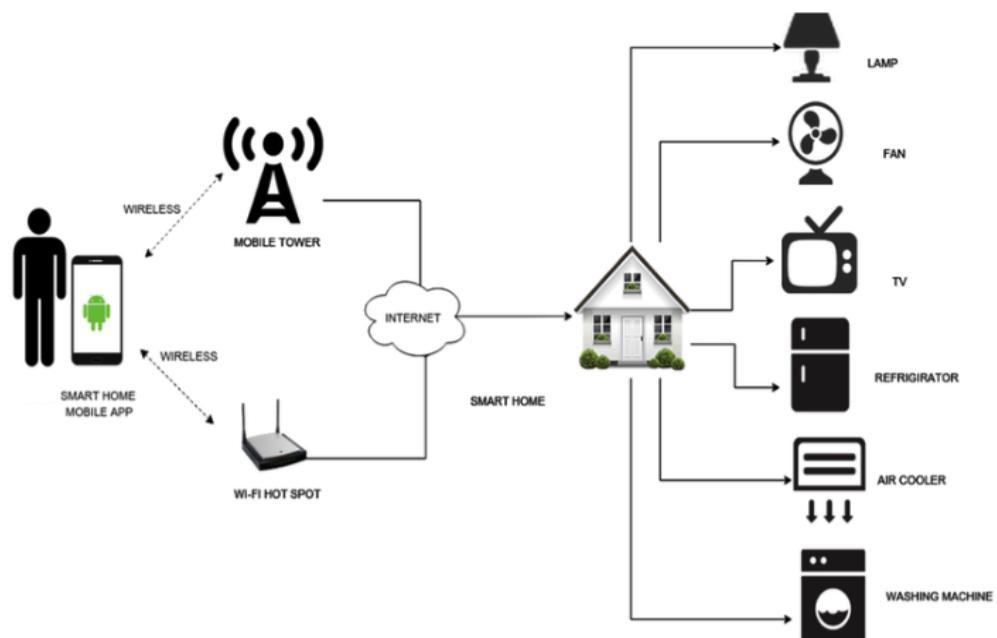


Figure 1 Concept of Smart Home

Simplicity and convenience make good home systems more attractive. Like the way they interact, makes it easier to manage performance. IoT smart home devices enabled us to reduce energy costs and to save time [2]. Nowadays, smart homes are using a lot of ingenuity and are costly for continuous

development in reducing costs and electricity as well as information and communication technologies, especially Internet of Things technologies. The Internet of Things is one of the biggest advances in telecommunications in recent years, connecting the Internet with everyday sensors and devices for connecting physical and virtual devices with data exploitation [3]. Thing speak is an IoT analytics service that lets you combine, view, and analyze live streaming data in the cloud. You can send diagnostic information to communicate from your devices, create live surveillance data, and send alerts using web services like Twitter [4].

BACKGROUND

Various approaches had been proposed in literature for home automation. Hoque et al elaborates the use of IoT in the common house and the interaction with the materials. This paper sheds some light on the difficulties one will face with the effects of IoT policies, context awareness and security. The author argues that IoT will be introduced on a much larger scale and therefore these issues should be well taken care of. The author goes on to discuss how architecture incorporating IoT into a smart home system can transform everyday life from very small to very high [3].

The paper presents the awareness that how a house can easily be converted into a smart home. The key defined in this broadside is used to incorporate safety measures, good light, energy efficiency, and other factors that can be measured and remotely controlled. Different features of this house have a single interface through which one can communicate. The approach of this paper is to provide improved personalization methods, mainly based on CIoT (Consumer Internet of Things) especially for smart home applications [5]. Elraway et al demonstrates the concept of transparency. The concept suggested in this paper is realistic, durable, affordable, and easy to use and installed. So the designer is targeting all sectors of society by providing improved control of home furnishings, thus joining technology with the public is beneficial for achieving social welfare [6].

Vasicek presents the complications and difficulties that can arise after implementing desirable functions and new technologies that can help to reduce some of them i.e. CPLD control, zigbee modules and RF modules. IoT environment and home security system are very low on server side security, As the application can be problematic you can control various issues. In this kind of problems a network structure should be created when data on each device can be connected, So to make the environment safer and very close to the server we can use Kerberos technology [7]. Zhou et al picks up that practical application which is the use of IoT monitoring and automation system. The purpose of controlling home appliances via Smartphone is using Wi-Fi as announcement protocol and Arduino as a chief regulator. This scheme offers a completely intelligent environment and monitors various sensors to provide the information needed to automatically detect and troubleshoot any problem on devices. Temperature and travel detection are stored in the cloud [8]. This paper proposes a home system that uses IoT efficiently, and sets out the design of the system through the construction of Internet of Things. In addition, the program gateway is built in parts from

Hardware to software. The ZIGBEE cycle, the 3G module, and the video module rotation are courtesy of the S3C2440 microprocessor. In addition, it is defined software based on the Linux embedded operating system [9]. Chen et al gives an innovative home-based program for the elderly, advanced by the technology for the help of friends of the third party environment (TAFETA). It introduces sensory machineries joined into the system and advances the context for processing and communicating the evidence released. It also deliberates the adoption and impact of these technologies from the viewpoint of potential employees [10].

Mockri et al identified the social blockades to smart housing acceptance by the examination of professional views and communal arrogances. Smart home services are designed to enhance the ease, expediency and safety of homeowners, Besides it allows them to use more energy and manage with rising costs [11].

IOTSH FEATURES

IOTSH refers to Internet of Things based Smart Homes. Smart homes are loaded with number of smart features [12]. These features may be just smart or be intelligent with AI. Few well-known features are as follows,

Lighting



Figure 2 Features of Smart Home

Lighting stands as essential part of home and offices. It is used to luminate the space upon users choice. Smart home allows to user to control lights via mobile or web panel. It reduces the electricity cost and increase the life of lighting appliances.

Security

Smart home provides the security to another level. User can monitor their homes via mobile and cloud services even if they are away from home. Advanced smart homes providing real time monitoring via smart camera and object detection technology.

Environmental Factors

The handler will be able to regulate the heating and cooling of the household, using both frequency and parameter-based options. Smart homes provide the real time statistics of temperature, humidity etc. Advanced smart homes allow to handler to select the temperature level insides the house.

Appliances

Smart homes provide the smart control over digital appliances of house. Air conditioner, electric motors and fans are controlled via mobile or web panels.

Smart Parking

When a car approaches a household drive, the system must be able to aware the owner. Automatic parking and security is provided by smart homes.

Smart Door

Smart housing system is developed to help such people who can perform simple tasks such as opening and closing doors. Door are automated via servo motors and secured via finger print and eye detection systems. Currently, the technology working on health door that sense the current health level of door passers.

Smart Alarm

An active feature in a home-based system can be the use of a clock, for example, the user will be able to choose from a wide collection of sounds ranging from very pleasant sounds to many types of piercings. Handler can setup different alarm according to their needs.

Laundry Machines

Laundry machines are automated with smart homes. These machine can intelligently wash the clothes.

Entertainment

With a fully-capable home, entertaining structures may be the new thing to introduce. Smart homes are incorporated with entertainment systems.

MAIN CONTRIBUTIONS

Sr.	Author Name	Contribution
1.	Gnana et al. 2020	In this paper, authors have given a prototype of an energy management system. They have used Raspberry Pi,

		ARDUINO and electric current sensors to detect the power consumption of each individual device in a smart home. They then use data analytics to do smart reporting and online billing [13].
2.	Adiba et al. 2019	Authors have implemented a test smart home with complete automation using IoT. The system is managed remotely using smart phones and it can sense security and safety issues e.g. with gas leakages and fire alarms. The system also provides checks for temperature and humidity and automates fans and lights. Users get alerts for any issues using email, SMS and alarms [14].
3.	Marco et al. 2020	This paper is a review on 6G use cases and its enabling technologies, which facilitates smart homes, smart cities, AR/VR, factory automation, holographic telepresence and eHealth. They discuss how to achieve terahertz communication, sub-ms latency and integrating intelligence in the network [15].
4.	Xuemin et al. 2020	This paper gives details on how to design a next generation wireless network that will facilitate the scenarios of smart cities, smart societies, augmented/virtual reality, autonomous driving, IoT based device to device communication etc. They give detailed deep learning and reinforced learning based techniques to do efficient network slicing, and selection of radio access technology [16].
5.	Roberto et al. 2019	Authors make the IoT and smart devices more securing by introducing the concept of Internet of Entities IOE which uses blockchain based ledger and smart contracts to ensure security, anonymization and immutability for these devices. The domains of IoE is eSecurity, eHealth and smart cities [17].
6.	Satyendra et al. 2019	Authors gave a hardware based home automation system using google assistant and NodeMcu controller. The system uses voice commands from android phones remotely to control the various sensors and devices [18].
7.	Marufa et al. 2020	This paper gives a framework for IoT based Green energy efficient smart traffic light system, which operates using various sensors including fog, smoke light and proximity sensors. The system generates its own energy using both wind and solar panels. This system will decrease the cost and improve the performance of the lighting system [19].
8.	Ahmed et al. 2019	In this paper, few factors are highlighted to ensure the attractions of the user acceptance of smart homes. The innovations, awareness, joyfully, and above all trustworthy infrastructure are the major factors to measure the level of acceptance by the user. This research paper is based on the survey and the results might not reflect the actual figure of reality [20].
9.	Abdulsalam et al. 2020	The article put attention of smart home users and industry to target the need of improvement in devices used in smart homes and their related application to manage these devices. The concept is related to continual service improvement that helps the commuter to minimize resource utilization during peak usage and industry to use every day’s data to improve the services by using fog devices and cloud computing [21].

10.	Shaam et al. 2020	An IoT and Cloud based solution with, Node MCU microcontroller, and android application, which gives the user remote access to monitor a smart home [22].
11.	Daniel Minoli 2019	This paper reviews the challenges related to the blockchain based IoT-smart home applications. As blockchain requires sufficient processing power, they suggest placing it on the fog-to-core gateway [23].

IOT ENABLING TECHNOLOGIES

IoT is powered by numerous technologies including cloud computing, wireless networks, machine learning, edge computing, big data analytics etc.

Wireless Sensor Network (WSN)

The wireless sensor network includes a distributed sensor network that is used to monitor ecofriendly environment. WSN contains a number of n-end-nodes as well as routers and an intermediary. Only Nodes with multiple sensors devoted to them on a lump can act as routers. Directors stand answerable for moving data packs from edge to planner. The planner collects data from all lumps. The intermediary acts as a gateway connecting WSN to the Internet.



Figure 3 Wireless Sensor Network

The weather monitoring system uses WSNs where nodes collect temperature humidity and other information gathered and analyzed. The humidity monitoring system uses WSNs to monitor soil moisture at different locations. The system practices WSNs to collect and investigation of data of buildings [24].

Cloud Computing

Cloud computing is emerging technology that provides online storage to IoT sensed data for fast processing. Cloud computing (CC) suggests a new running approach to big data that allows handing out data and extracting valued

information from it [25]. Following are key factors effecting upon the performance of cloud computing,

Synchronization: Synchronization among various cloud providers presents the challenge of delivering real-time services because the facilities are made over multiple diverse cloud stages.

Standardization: A typical cloud computing poses an important contest for cloud-based standardization due to the collaboration with various wholesalers.

Security: The safety of IoT cloud facilities comes up with additional challenges because of the differences in security mechanisms amongst cloud platforms and IoT devices.

Reliability: Reliability is another factor of performance for cloud computing. Unreliable delivery of services brings multiple issues.

Management: Managing cloud computing and IoT systems is a challenge because they both have dissimilar infrastructure and mechanisms.

Enhancement: Ensuring IoT-based cloud amenities are needed to ensure the provision of good comforts that encounter consumer potentials.

IoT can use multiple cloud platforms with different capabilities ThingWorx, OpenIoT, Thingspeak, Pubnub, Adafruit, Amazon, GENI, Google Cloud etc. For example, Xively (formerly known as cosm and Pacific) represents one of the leading IoT service providers to launch information that will be available on the web. Xively objects to join networks for secure applications in actual time [26].

Edge Computing

Edge Computing can serve as a link amongst smart devices, immense cloud services and hosting services. By using fog, it is likely to spread the cloud computing service to network devices. Due to their close proximity to comparing users with cloud data centres, the edge computer has the potential to provide services that distribute improved suspension performance [27]. Huge difference between the cloud and it has greater storage and communication capabilities compared to the edge computing. Mobile network operators are latent providers of cloud computing because they can provide cloud services as one of the SaaS, PaaS, or IaaS infrastructures for business enterprises. Fog computing can assist as an optimal choice for the IoT inventers for the following features [28],

Location: Edge resources for locations are located amongst smart devices and cloud data-center facilitate on edge computations.

Distribution: Since fog cloud is based on "small" centers with partial packing, dispensation and memo associated to the cloud, it is likely to spend more facilities and cost is relatively insignificant related to cloud data centers.

Scalability: The edge allows IoT arrangements to be scalable as end users increases, the number of "small" fog centers used can rise to deal with increased load.

Density of devices: edge offers reusable and repetitive services. Therefore, the fog computing supports to increase the complete efficiency of IoT applications as it tries to achieve part of the innovative cloud-based services within limited resources.

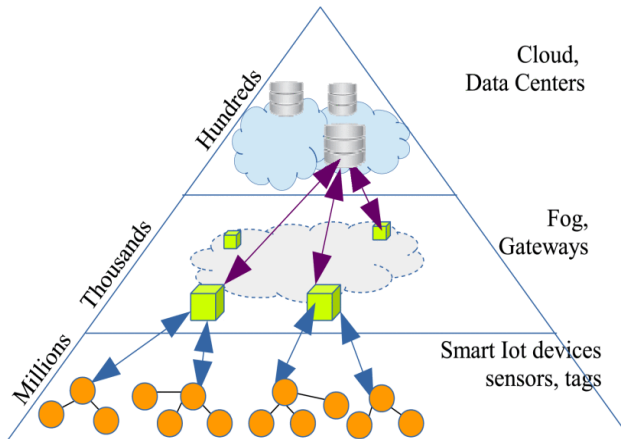


Figure 4 Edge Computing

Big Data Analytics

Big Data Analysis is the procedure of gathering, forming and examining large data sets (called Big Data) to find designs and additional information [29]. Big Data analysis can be beneficial to recognize the info contained within the data and will likewise help to gain more valuable insights into business and future business decisions. Analysts working with Big data often seek information after evaluating data [30].

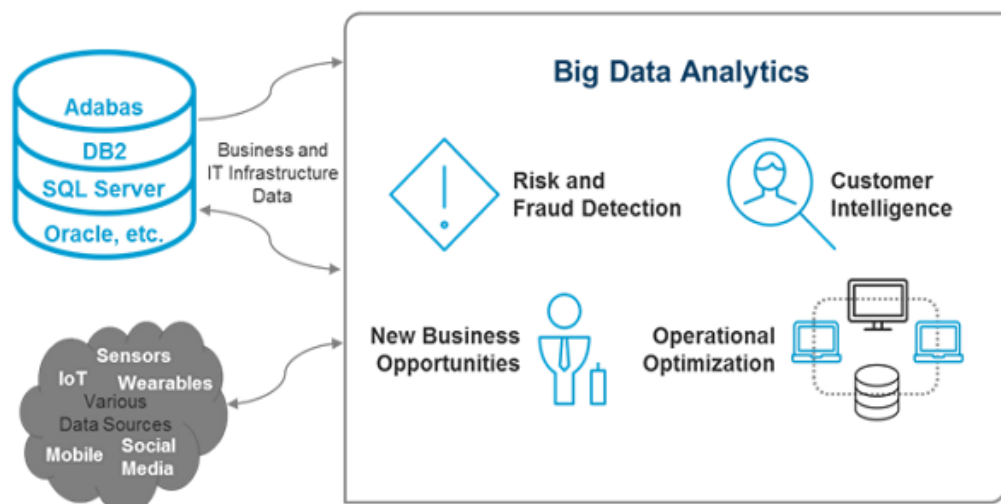


Figure 5 Big Data Analytics

Some examples of big data generated by IoT systems are described as follows:

1. Weather monitoring system is generated through sensors.
2. Healthiness and fitness data generated by IoT devices such as physical fitness bands.

3. Information generated by local IoT systems and vehicle tracking.
4. Details produced by sales record.

Big data can be defined by the following features,

Volume – The amount of data generated and stored. The size of the data determines the amount and insights that can exist, and whether or not they can be considered big data.

Variety – The type of data. This helps analysts to make more effective use of the outputs. Big data attracts text, images, audio, video; and fills in the missing pieces with data integration.

Velocity– The swiftness at which data is made and processed to meet the needs and contests is in the way of evolution and progress. Big data is often available in real time. Related to small data, big data is formed continuously. The two types of Big Data-related intimacy are the frequency and frequency of handling, recording and publishing.

Variability - It is a prolonged definition of big data, costing data quality and amount of data. The superiority of the taken data can differ greatly, affecting correct breakdown.

CONCLUSION

Automation revolutionizing the humans lives by transferring manual processes to automatic and intelligent process. Internet of things is key enabling technology to automation. IoT applications is very vast from smart agriculture to smart industry, smart education to smart health and smart buildings to smart society. Smart homes are part of smart and green buildings. The home appliances and processes can be automated to ease the human lives as well as to save electricity, providing high security etc. In this paper, we highlighted the idea of smart homes with state of the art features. After that, we have reviewed the research contributions in context of smart homes. The transformative effects of smart homes on smart society has been discussed. Furthermore, we have elaborated the IoT supportive technologies for automation.

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